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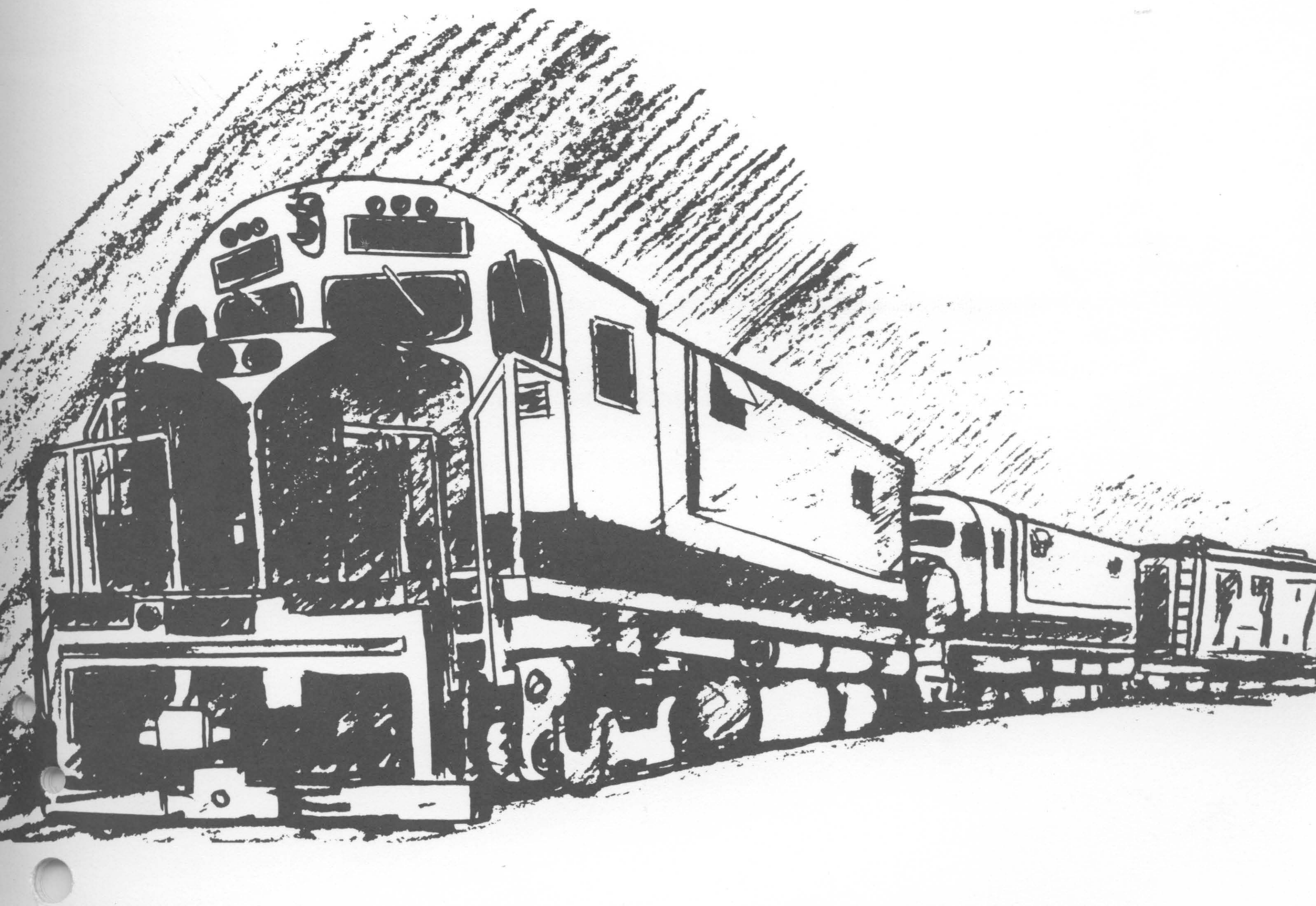
Contracting Rail Freight Services for Country Elevators in the Texas Panhandle



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CONTRACTING RAIL FREIGHT SERVICES FOR COUNTRY ELEVATORS IN THE TEXAS PANHANDLE

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Summary

The Stagger Rail Act of 1980 has legalized contracts between shippers and carriers. Generally, contracts between rail carriers and grain shippers involve volume commitments from the shipper in exchange for lowered rates. Multicar grain shipments lower railroad costs; accordingly, railroads are often willing to contract at reduced rates to grain handlers making multicar, point-to-point shipments. Unfortunately, many country elevators are not capable of making multicar grain shipments for which significant rate reductions are offered. This study focuses on the economic feasibility of upgrading 10 elevators to load-out multicar wheat shipments in a 15-county area in the upper portion of the Texas Panhandle. The study shows that careful and thorough analysis must be carried out by elevator management before investing in multicar shipping capacity and contracting with railroads.

CONTRACTING RAIL FREIGHT SERVICES FOR COUNTRY ELEVATORS IN THE TEXAS PANHANDLE

Stephen Fuller

INTRODUCTION

Contracts between shippers and rail carriers were legalized by the Staggers Rail Act of 1980. Contracting allows the railroads to plan service and allocate equipment more efficiently while simultaneously assuring shippers of specific services at established rates. Contracting permits railroads and shippers to recognize special transportation requirements and to enter into agreements which may bring economic advantage to both parties (6).

Negotiated railroad contracts generally involve rate and service provisions and may include additional features which are important to either shipper or carrier. The inflexible tariff rates of common carriers may be replaced by a fixed rate or any rate schedule the parties to the contract may devise and agree upon. Other contract provisions may involve a change of service levels to better fit shipper needs. Additional contract provisions may deal with dispatch, noncompliance, methods of adjudication, and damage provisions (1).

Many contracts between rail carriers and grain shippers involve volume commitments from the shipper in exchange for lower rates. Railroads are able to reduce operating costs through multiple-car, point-to-point grain movements. Multicar shipments generally expedite equipment handling, shorten equipment turnaround, and permit more productive use of railroad capital. Therefore, railroads are willing to contract at reduced rates to grain handlers that make multicar, point-to-point shipments. Unfortunately, many country elevator facilities are not capable of making multiple carload shipments for which significant rate reductions are offered. Most contract arrangements allow the grain shipper only 24 hours for purposes of loading the multicar unit. Most country elevators do not have the necessary rail car loading capacity nor track space (rail car holding capacity) to accommodate multicar shipments, thus, substantial investment may be necessary before contracting can be an alternative (5). Presumably, the lower rail rates resulting from new elevator investment would ultimately be reflected in higher farmer grain prices which would subsequently expand the elevators' market area and volume. Obviously, the feasibility of upgrading country elevators and contracting is dependent on the economic returns associated with the investment in new multicar handling facilities.

This study focuses on the economic feasibility of upgrading 10 country elevators to load multicar wheat shipments in a 15-county area in the upper portion of the Texas Panhandle (Figure 1). The 10 selected elevators are located at Dalhart, Hartley, Stratford, Lautz, Etter, Dumas, Spearman, Perryton, Panhandle, and Pampa, Texas. The economic feasibility of upgrading the elevators is evaluated under different rail rate reductions, investment costs, wheat production levels, and elevator gross margins. In addition, the analysis examines the effect of a lack of short-line railroad operation (Texas North Western) on the feasibility of upgrading investment in nearby country elevators. The selected study region is a major producer of corn, sorghum, and wheat; however, the intensive cattle feeding activity in the area consumes much of the feedgrain production. Thus, wheat is the principal grain exiting the region and in most cases is destined for export. It is estimated that 75 to 95% of the area's annual wheat production moves to foreign destinations. Since export movements lend themselves to multicar, point-to-point hauls, the economic feasibility of upgrading is based only on anticipated wheat volumes at the 10 potential multicar loading facilities.

The 15-county study region is located approximately 725 miles from Texas Gulf ports. This region is served by country elevators located at 53 separate cities; 44 of these locations are served by railroads while 9 locations have only truck service. The Atchinson, Topeka and Santa Fe (ATSF), Burlington Northern (BN), Texas North Western (TNW), and Southern Pacific (SP) railroad companies operate in the study area. The ATSF and BN railroads are the area's principal grain carriers. Historically, the region's railroads offered a single-car transit rate which allowed wheat to be shipped from country elevators to Gulf ports on a single car through-rate that included a stop-over at inland terminals. A grain shipper's transportation charge on export-destined wheat was not unfavorably affected by transshipment at inland elevator locations, accordingly, substantial volumes moved through these facilities. Much of the study area's wheat production moved to inland terminals at Enid, Oklahoma and Amarillo, Texas. In 1981 ATSF introduced multicar rates which continued to feature transit at inland terminals. These rates allowed one or more cars to be shipped from a country elevator to a transit station (inland terminal) and reshipped to a port facility in not less than 60 car

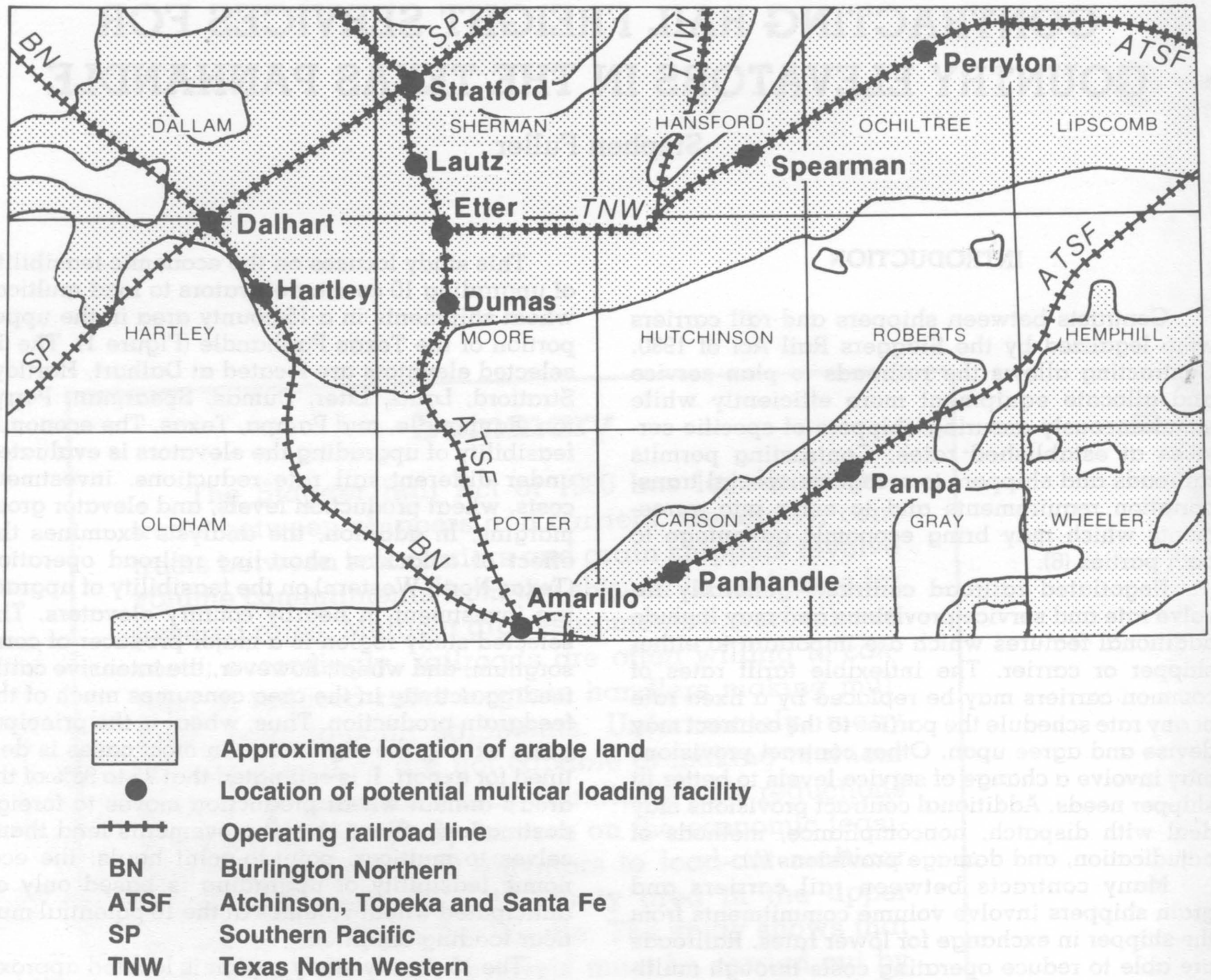

Figure 1. Fifteen-county study region with railroads, arable land, and country elevator locations considered as potential multicar grain loading facilities identified.

shipments. More recently the ATSF has offered several shipment options. These include: (1) the country elevator making direct 5-car shipments to port elevators, and (2) the country elevator shipping one or more cars to a transit station (inland terminal) for reshipment to a Gulf port elevator in not less than 25-car lots. In most cases, the transit station guarantees rates to the selling country elevator which reflect 25-car, out-bound shipments.

ANALYTICAL PROCEDURE AND STRUCTURE OF MODELS

Study objectives were accomplished in two separate phases of research activity. The initial phase involves estimating wheat receipts and gross margin revenues at the upgraded country elevators as these facilities' export rail rates are adjusted downward to reflect their shipments in multicar units. Additional elevator revenues associated with the upgraded elevators' increase in wheat volume resulting from the lower multicar rates are calculated with information generated in this research phase. In the second phase, elevator upgrading and operating costs are subtracted from the added revenues to calculate return on each elevator's upgrading investment. Insight into the desirability of remodeling the country elevator to handle multicar shipments is provided by the calculated return on investment.

The initial phase is accomplished with a least-cost network flow model which includes essential elements of the study area's export wheat marketing system. The decision to employ a least-cost framework to estimate wheat receipts at the upgraded elevators is based on several assumptions. First, it is assumed that elevators operate in a competitive environment and their farmer offering price is a reflection of costs incurred in grain handling and transportation of grain to principal markets; i.e., if an elevator's transportation charge is lowered, the elevator will offer an increased grain price to the farmer. Further, it is assumed that a farmer's elevator marketing decision is based on nearby elevator's offering prices and delivery costs to these elevators.

A cost-minimizing network model is developed to represent elements of the entire export grain marketing system. The model's principal elements include: (1) farm storage cost; (2) farmer grain delivery costs; (3) truck and rail transportation rates or costs that link country elevators, upgraded country elevators, inland terminals, and port terminals; and (4) elevator facilities grain handling costs or gross margins and storage costs.

The analytical model represents a wheat crop year (June 1 to May 30). The crop year is subdivided into three time periods to make a chronological analysis. Based on historical data it was determined that the first time period, the harvest period, includes 21 days. During this time period annual wheat supply is generated. The following 45-day period represents post-harvest repositioning activity, and the final period is the remaining 299 days of the crop year.

To develop the network model, the 15-county study area was subdivided into 3 × 3 mile areas (9 square miles) and 4 × 4 mile areas (16 square miles) resulting in 1,251 production origins or farms. The harvest-time wheat supply and available wheat storage at each production origin was predetermined. Producers may store their wheat production at farms (production origins) for later delivery by farm truck to country elevators or upgraded country elevators or they may ship to these facilities at harvest. Any country elevator or upgraded country elevator within 30 miles of a farm represents a potential delivery point. Wheat must be gathered and sent to country elevators or upgraded country elevators prior to further movement through the export grain marketing system.

Country elevators and upgraded country elevators included in the network model have predetermined quantities of storage capacity available for area wheat production. Country elevators may ship to an upgraded elevator, inland terminal, or Gulf port terminal. Any movement from country elevator to upgraded elevator is constrained to less than 80 miles. Truck and rail modes are available for all country elevator shipments to inland and port terminals, only truck carriage is available for movements from country elevator to upgraded elevators.

The described least-cost model is used to estimate elevator wheat receipts before and after the lower multicar rates are introduced at the 10 country elevators. In addition, the model is used to evaluate several scenarios that reflect changes in the economic and wheat production environment. Analysis with the network model estimates the effect of changing wheat production levels, alternative multicar rate reductions, and nonoperation of a short-line railroad (Texas North Western) on volume of wheat received at the 10 studied elevators. Information on the elevators' wheat receipts is subsequently used in the second phase of the analysis to calculate the effect on return to upgrading investment.

The return on elevator upgrading investment is calculated in the second phase of the analysis. Based on estimated elevator wheat receipts (first phase) and gross margins (free on board [f.o.b.] elevator grain sale price - farmer price), elevator revenues are calculated. Elevators' estimated costs are subtracted from revenues for purposes of estimating returns. In general, the following steps are followed for purposes of estimating the rate of return on new elevator investment.

1. Elevator returns, prior to new investment, are calculated by subtracting estimated costs from revenues.
2. Elevator returns after investment are calculated and subtracted from returns prior to the new investment for purposes of estimating return attributable to the upgrading investment.
3. Returns attributable to new investment are divided by the estimated value of this investment for purposes of calculating a rate of return.

Analysis is carried out to identify how differing levels of elevator upgrading investment and gross margins impact the rate of return on upgrading investment at the 10 elevators. Rate of return is estimated for investments necessary to facilitate loading of 25-, 50-, and 75-car grain shipments and for six gross margin levels. Rate of return was estimated with use of a developed computer model.

The following list identifies data required for calibration of the identified models and for carrying out the necessary analysis.

1. Production Origins
   - Quantity of wheat harvested
   - Wheat storage capacities
   - Cost of on-farm wheat storage
2. Country Elevators and Upgraded Country Elevators
   - Grain handling and storage capacities
   - Gross margins
   - Costs of upgrading elevators to accommodate multicar shipments
   - Costs of handling and storing wheat
   - Grain inventory cost of multicar grain shippers

3. Inland and Port Terminals
   Grain handling and storage capacities
   Costs of handling and storing wheat
4. Transportation
   Cost of transporting wheat by farm truck to nearby country elevators
   Costs of transporting grain by commercial trucker from country elevators to upgraded elevators, inland terminals and port terminals
   Rail rates associated with moving wheat from country elevators to Gulf ports

DATA

This section describes how the parameters used in this analysis were developed.

Wheat Supply and Farm Storage Capacity

Because annual variability in wheat production may impact the expected return on investment, a historical review of wheat production in the study area was conducted. This revealed substantial variability in annual wheat production in the 15-county region. (Table 1). Between 1970 and 1982 the study area wheat production varied from a low of 14.1 million bushels (1974) to a high of 48.3 million bushels (1979). County-level production data also revealed extensive variability. Coefficients of variation ([standard deviation ÷ mean] × 100) were estimated for each county's wheat production—the estimated parameters range from 35.2 to 58.7%.

To identify whether annual county wheat production in the 15-county area varies in a similar manner, a simple correlation analysis was performed. Results indicate a strong positive correlation between county wheat production levels; this indicates annual county wheat production in the 15-county study area tends to vary similarly. Thus, scaling each county's production in a similar manner in order to reflect varying study area production levels is a valid procedure. Accordingly, returns to investment were estimated for 10 elevator locations at regional production levels of 21.6, 28.4, and 35.7 million bushels. The 28.4 million-bushel production level approximates average production while the 21.6 and 35.7 million bushel values approximate the upper and lower bounds of a 95% confidence interval estimated for the 15-county study area wheat production.[1]

A county's wheat production was estimated by determining the portion which the county had historically contributed to the 15-county area and multiplying this portion by study area production (21.6, 28.4, and 35.7 million bushels). A county's estimated production was distributed among its production origins (3 × 3 and 4 × 4 mile areas) on the basis of cultivated land area in each production origin. Quantity of cultivated land in each production origin was estimated from the Soil Conservation Services aerial photographs (7).

To estimate on-farm storage in each county, a 1978 Agricultural Stabilization and Conservation Service (ASCS) survey was updated by telephone interviews with ASCS office managers in each of the 15 counties. Office managers were asked to verify the reasonableness of the 1978 survey results and estimate amount of storage added since 1978. Study area counties were estimated to have 14.4 million bushels of on-farm storage. The estimated wheat production associated with each county's production origin was the basis for estimating its on-farm storage. (8).

TABLE 1. FIFTEEN-COUNTY STUDY AREAS' ANNUAL WHEAT PRODUCTION, 1970-82

Year	Wheat Production (1,000 bu)
1970	16,241
1971	15,486
1972	17,542
1973	41,768
1974	*14,148*
1975	37,453
1976	30,034
1977	27,752
1978	15,238
1979	48,261
1980	37,876
1981	37,819
1982	37,950

Source: *Texas Small Grain Statistics*, Texas Department of Agriculture, Statistical Reporting Service, USDA, Austin, Texas.

Farm Assembly Cost

Cost of truck-transporting wheat from area farms (production origins) to country elevators was based on a Texas Crop and Livestock Reporting Service publication entitled, "1981 Texas Custom Rate Statistics." This study showed producers in the Plains area paying a flat rate of $.10 per bushel (/bu) for hauls of 11 miles and less. For hauls in excess of 11 miles, the flat rate ($.10/bu) plus a per mile rate of $.01/bu was applicable; i.e., for a 15 mile haul the rate would be $.14/bu.

[1]Several major economic forces appear to affect study area wheat production. Government programs in the 1960's and early 1970's curtailed wheat production, thus the low production levels in 1970-72. Expanding foreign wheat demand in the mid- and late 1970s resulted in expanded wheat production while increasing energy costs (rising energy costs increased cost of irrigated feed grain production) in the latter 1970's improved the relative profitability of wheat production. Estimating future study region wheat production involves numerous risks. The study region's average wheat production of 28.4 million bushels appears to be a conservative estimate since the annual production from 1978-83 approximated or exceeded the upper estimate of 35.7 million bushels. In view of moderating foreign wheat demand the more conservative estimate may be preferable for purposes of planning elevator investment.

Farm Storage Cost

Farm storage cost includes three cost items: (1) cost of placing wheat into storage, (2) cost of wheat storage, and (3) cost of removing wheat from storage. The cost of placing wheat into farm storage was estimated to be \$.0285/bu while per bushel removal cost was estimated to be \$.0195. Estimates of variable on-farm storage cost was based on a recent study which developed cost budgets for alternative size steel bins (2). Based on an earlier survey, it was estimated that 5,000-, 10,000-, and 20,000-bushel steel bins comprised 38, 20, and 42% of the study areas' on-farm storage capacity. The weighted annual on-farm variable storage cost was estimated to be \$.18/bu.

Country Elevator Storage, Gross Margins, and Costs

Country elevator grain storage capacities of the study area's facilities were taken from federal and state grain warehouse license directories. Detailed information on the grain handling and storage capacities of the 10 renovated facilities was obtained from interviews with elevator management.

To calculate the renovated elevators return on new investment, information on per bushel gross margins (f.o.b. elevator grain sale price - farmer price) and costs were required. Information on per bushel gross margins was obtained from a survey of Texas Panhandle country elevators. The survey was conducted by the Texas Agricultural Extension Service and Texas Grain and Feed Association in August 1982.[2] Survey results indicate elevators to have had an average gross margin of \$.215/bu of received wheat and a per month storage charge of \$.023/bu in 1982.

Based on information provided by financial institutions and grain elevator management, three elevator cost models were developed. Costs were developed for 600,000-, 800,000-, and 1,000,000-bushel elevator plant firms. This plant size range approximated that of the 10 elevators to be upgraded. The plant size cost model, which was most like the bushel storage capacity of the upgraded facility, was selected for estimating elevator costs. Plant depreciation estimates of existing plants varied and in some cases plants were fully or nearly depreciated. Depreciation of existing plants was not an estimated expense. However, annual depreciation expense associated with elevator upgrading was included in the analysis for purposes of estimating rate of return on upgrading investment. Calculation of this expense is shown in a later section.

Full-time personnel was a major expense and included salaries for a manager, bookkeeper, weigh scale operator, and elevator superintendent. Table 2 shows the base salaries of these employees. Salaries were adjusted to reflect changing plant volume levels, and were increased 1% for each 10% increase in volume above the elevators rated storage capacity; i.e., if a 1 million-bushel elevator were to annually handle 1.1. million bushels, the full-time employee salaries would be increased by 1%.

The need for part-time employees was based on the elevator's annual volume. The following equation was used to estimate hours of part-time elevator and office help:

Part-time elevator help (hours) = 150.0 + 0.00075V,

Part-time office help (hours) = −300.00 + 0.00075V where,

V = annual elevator volume in bushels

The estimated cost of part-time labor, including per hour wages and benefits, was \$5.30.

A \$.02/bu charge represents utility costs. Miscellaneous expenses include grain fumigants, office supplies, postage, advertising, and maintenance and repair. These cost items are determined by elevator size. The 600,000-, 800,000-, and 1,000,000-bushel elevator models had an estimated per bushel miscellaneous expense of \$.05, \$.045, and \$.04, respectively. Inventory insurance was based on a rate of \$.12 per \$100 of grain inventory. Inventory value was based on a 60% occupancy rate and a per bushel grain value of \$3.25. See Figure 2 for graphed average cost relationships of the 600,000-, 800,000-, and 1,000,000-bushel cost models.

Investment Costs of Upgrading Country Elevators to Handle *Multicar Grain Shipments*

On-site inspection by experienced elevator construction personnel would have been required to precisely estimate upgrading costs at each studied country elevator. Since this was not feasible, an alternative procedure was used. General characteristics of each elevator were collected by telephone interviews with elevator management and this information subsequently related to individuals with experience in remodeling country elevators for purposes of accommodating multicar grain

TABLE 2. ESTIMATED BASE SALARIES OF FULL-TIME PERSONNEL IN THE 600,000-, 800,000- AND 1,000,000-BUSHEL ELEVATOR COST MODELS, 1982[1]

	Elevator Cost Model		
	600,000 bu	800,000 bu	1,000,000 bu
Manager	\$22,000	\$25,500	\$29,000
Bookkeeper	17,000	20,500	24,000
Scale Operator	15,000	17,500	21,000
Elevator Superintendent	15,000	18,500	22,000

[2]Survey was conducted by Ed Smith, Extension Economist, Grain Marketing and Policy.

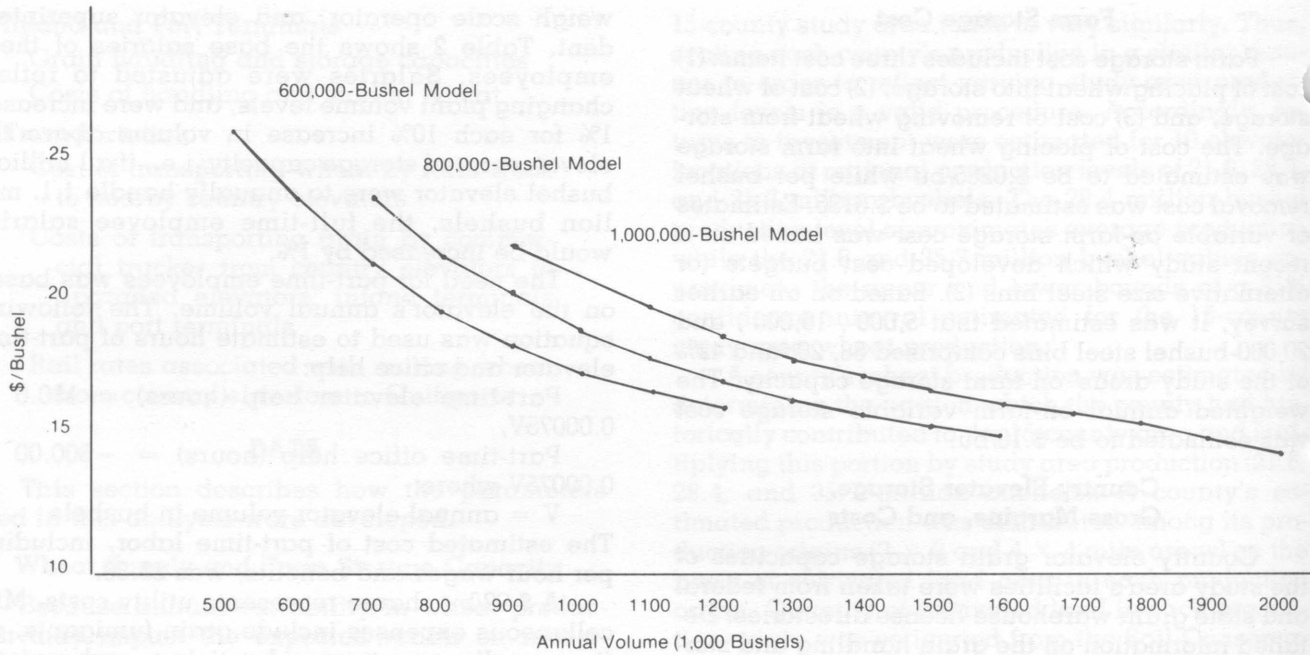

Figure 2. Estimated average full-time and part-time labor costs, insurance, utilities, and miscellaneous costs for the 600,000; 800,000; and 1,000,000 bushel elevator cost models.

shipments.[3] Information was collected on storage capacity of the largest concrete house at each location, number of legs included in this facility and their per hour elevating capacity, truck receiving capacity, per hour grain handling capacity of the bottom belt, railcar holding capacity, availability of a car puller and trackmobile, and ability of the facility to simultaneously receive and load grain. All study elevators are constructed of concrete and most have storage capacity ranging between .7 and 1.2 million bushels. Most elevators have (1) two legs with per leg capacity ranging from 6,000 to 8,000 bushels per hour (bu/h), (2) truck unloading capacity ranging from 6,000 to 10,000 bu/h, (3) bottom belt per hour capacity which approximates the capacity of the two legs, and (4) the ability to simultaneously receive and load grain. Industry personnel judged each elevator's characteristics to be generally alike and remodeling costs to be similar. Investment costs were estimated at $210,000, $333,000, and $435,000 for remodeling the studied elevators to handle 25-, 50-, and 75-car grain shipments, respectively. These costs include modifications in spouting and belts, additional leg capacity, a track scale, and an automatic sampler. These costs reflect facility modification which enable per hour load out capacities of 15,000, 25,000, and 30,000 bu/h at the 25-, 50-, and 75-car grain handling facilities, respectively. Table 3 identifies the estimated investment costs of remodeling.

New elevator investment is required in railcar track capacity to accommodate additional cars associated with the 25-, 50-, and 75-car shipments. Estimates of additional trackage were calculated from information on each facility's current rail siding and the estimated amount of siding to handle the 25-, 50-, and 75-car shipments. It was assumed that a trackmobile would be required at each location for shuttling railcars. Table 4 identifies the estimated investment cost of a used trackmobile and additional track at each elevator.

[3]Numerous individuals, academic institutions, and firms were contacted for purposes of estimating elevator upgrading costs. These include: (1) Ming-Hong Chow, Department of Economics, Kansas State University; (2) Frank Meyer, Custom Metal Fabricators, Herington, Kansas; (3) Bill Sanders, Evans Grain Co., Salina, Kansas; (4) L. D. Schnake, USDA-ERS, Manhattan, Kansas; (5) Gene Theyer, Montana Merchandising Inc., Great Falls, Montana; (6) G. F. Cook Contruction Co., Minneapolis, Minnesota; (7) Dave Treffer, Ehrsam Products, Salina, Kansas; and (8) Blaine Pounds, Burlington Northern, St. Paul, Minnesota.

TABLE 3. ESTIMATED INVESTMENT COST OF REMODELING COUNTRY ELEVATORS TO HANDLE 25-, 50-, AND 75-CAR GRAIN SHIPMENTS

	Investment Cost		
		Grain Shipments	
Item	25-car	50-car	75-car
Leg, Spouting, Belts	$125,000	$200,000	$260,000
Track Scale	75,000	115,000	150,000
Automatic Sampler	10,000	18,000	25,000
Total	$210,000	$333,000	$435,000

TABLE 4. ESTIMATED INVESTMENT COST AT EACH ELEVATOR FOR ADDING TRACK AND A TRACKMOBILE TO MAKE 25-, 50-, AND 75-CAR GRAIN SHIPMENTS

Elevator Location	Investment Cost — Grain Shipment 25-car[1]	50-car[1]	75-car[1]
Dalhart	$126,520	$284,520	$452,520
Stratford	63,600	175,000	389,600
Lautz	97,920	255,920	423,920
Spearman	137,960	295,960	463,960
Perryton[2]	35,000	50,000	75,000
Hartley	35,000	193,000	361,000
Etter	126,520	284,520	452,520
Dumas	103,640	261,640	429,640
Panhandle	126,520	284,520	452,520
Pampa	103,640	261,640	429,640

[1]Costs include a used trackmobile with an estimated purchase price of $35,000, $50,000, and $75,000 for a 25-, 50-, and 75-car grain handling facility, respectively. Personnel experienced in country elevator remodeling estimated 110 ft of trackage to be required for each additional railcar of holding capacity. The per foot cost of this investment was estimated to average $52 and included costs of track, ballast, ties, and switches.

[2]Management at this location indicated adequate track capacity to load the 25-, 50-, and 75-car grain shipments.

Annual Fixed Costs Associated with Upgrading Country Elevators

Annual fixed costs include depreciation, interest on investment, and additional facility insurance and property taxes. Assets were depreciated using the straight-line method. Investment in additional rail trackage was depreciated over a 40-year period, while the trackmobile was assumed to have a 15-year life. Remodeling investment in the elevator (leg, belts, automatic sampler) was depreciated over a 10-year period while the track scale was depreciated over 20 years.

Interest on investment was estimated at 10% on half of the total initial investment. Insurance on structures and installed equipment was estimated at 13.40 cents per $100 of initial investment. Property taxes were estimated by multiplying investment cost by .9, then dividing this value by $100, and multiplying the resulting quotient by $1.50.

Table 5 identifies the estimated annual fixed costs at each location.

Grain Inventory Costs

The single-car rate structure allows the elevator operator to ship grain as purchased from the producer. In contrast, multicar shipping organizations will require the elevator operator to accumulate a grain inventory equal to the quantity included in the multicar shipment. This will incur an additional cost. The estimated inventory costs of the multicar organization are based on the following assumptions: (1) Half of an elevator's annual wheat receipts are purchased at or near harvest, thus negligible inventory costs are incurred on this grain. The elevator's remaining per month purchases are made at a rate equaling 6% of the plant's annual volume; (2) Interest cost is 12%; and (3) Grain is valued at $3.25/bu.

TABLE 5. ESTIMATED ANNUAL FIXED COST ASSOCIATED WITH UPGRADING COUNTRY ELEVATORS TO ACCOMMODATE 25-, 50-, AND 75-CAR GRAIN SHIPMENTS

Elevator Location	Total Annual Fixed Cost — Grain Shipments 25-car	50-car	75-car
Dalhart	$43,568	$76,472	$107,478
Stratford	38,000	67,229	101,872
Lautz	41,217	73,940	104,947
Spearman	44,579	77,484	108,491
Perryton	10,231	55,717	74,068
Hartley	35,467	68,372	99,379
Etter	43,568	76,472	107,478
Dumas	41,543	74,446	107,329
Panhandle	43,568	76,472	107,478
Pampa	41,543	74,446	107,329

Figure 3 shows the per bushel inventory costs of a 25-car, 50-car, and 75-car loading facility at annual volumes ranging from 1.0 to 2.5 million bushels. As expected, per bushel inventory costs decrease as annual grain volume increases, whereas inventory costs increase as the size of the unit train to be accommodated increases.

Inland Terminal and Port Terminal Costs and Storage Capacities

The Economic Research Service (under USDA) has conducted a series of studies on grain handling and storage costs at inland and port terminals. Costs used in this study are based on a 1977 to 1978 estimate which was revised and upgraded to meet 1982 costs using producer price indices and volume estimates for more recent years.[4] The estimated per bushel variable cost of receiving grain from truck and rail modes at inland terminals is $.0275 and $.0345/bu, respectively. The estimated costs of loading trucks and rail modes is $.0238 and $.0312/bu, respectively. Per bushel variable costs of receiving truck and rail-delivered grain at port terminals are $.0211 and $.0227. The port elevators estimated per bushel variable cost of loading to ship is $.0153. Annual per bushel storage charge for holding grain at inland and port terminals is $.279.

Study area inland terminal and port terminal storage capacities were obtained from federal and state grain warehouse licensing agencies.

Commercial Truck Transportation Rates

In this study, truck movement of wheat from all elevators was assumed to be by commercial truckers. Rates are for diesel-powered, cab-over, twin screw, tractor-trailer rigs. Two sources of rate

[4]Analysis provided by Mack Leath, USDA-ERS, University of Illinois.

TABLE 9. ESTIMATED RATE OF RETURN ON 25-, 50-, AND 75-CAR UPGRADING INVESTMENTS WITH PER BUSHEL RAIL RATE REDUCTIONS OF $.05, $.075, AND $.10 AND STUDY REGION WHEAT PRODUCTION OF 28.4 MILLION BUSHELS[1]

	Estimated Rate of Return with Rail Rate Reductions of								
ELEVATOR LOCATION	$.05 (%)	$.075 (%)	$.10 (%)	$.05 (%)	$.075 (%)	$.10 (%)	$.05 (%)	$.075 (%)	$.10 (%)
	25-CAR INVESTMENT			50-CAR INVESTMENT			75-CAR INVESTMENT		
Dalhart	—	16.5	20.9	—	—	—	—	—	—
Stratford	—	17.7	26.7	—	—	—	—	—	—
Lautz	—	—	9.5	—	—	—	—	—	—
Spearman	19.0	24.1	32.0	—	—	12.5	—	—	—
Perryton	114.3	129.8	151.1	23.9	28.8	35.4	14.4	18.0	23.0
Pampa	15.3	19.0	21.5	—	—	—	—	—	—

[1]Estimated rates of return are based on a gross margin of $.215/bu. Results are only shown for those locations where combinations of investment levels and rate reductions yield rate of return approximating or exceeding 10%.

locations with low returns on upgrading investment have volume increases which average about 25%. The very high rate of return on elevator investment at Perryton is due to the substantial volume increase and the relatively modest investment which management indicated to be required in order to accommodate multicar shipments (Table 5).

High and Low Wheat Production Levels

Tables 10 and 11 relate the expected annual wheat receipts at the 10 elevator locations with study region production of 21.6 and 35.7 million bushels, respectively. Tables 12 and 13 identify for each production level the expected rate of return on upgrading investment at elevators where the estimated rate approximates or exceeds 10%.

In general the results are as expected. The subset of elevators', which generate attractive returns at the average production level (28.4 million bushels) are often suitable investments at the low and high production levels. However, the study shows the return on upgrading investment is positively correlated with the study regions level of wheat production. For example, Lautz is not a suitable investment at the lowest production level

TABLE 10. ESTIMATED ANNUAL WHEAT RECEIPTS AT STUDIED ELEVATOR LOCATIONS WITH EXISTING RATES AND THREE REDUCED RAIL RATE LEVELS, AND STUDY REGION WHEAT PRODUCTION OF 21.6 MILLION BUSHELS

		Per bushel rate reductions		
Elevator Location	Existing Rate	$.05	$.075	$.10
		(1,000 bu)		
Dalhart	567	931	1,111	1,196
Stratford	442	717	899	1,040
Lautz	494	712	794	863
Spearman	823	1,828	2,000	2,083
Perryton	1,067	2,075	2,256	2,429
Hartley	1,458	1,469	1,480	1,480
Etter	612	778	843	867
Dumas	762	880	957	957
Panhandle	816	876	897	934
Pampa	724	1,366	1,453	1,512

TABLE 11. ESTIMATED ANNUAL WHEAT RECEIPTS AT STUDIED ELEVATOR LOCATIONS WITH EXISTING RATES AND THREE REDUCED RAIL RATE LEVELS, AND STUDY REGION WHEAT PRODUCTION OF 35.7 MILLION BUSHELS

		Per bushel rate reductions		
Elevator Location	Existing Rate	$.05	$.075	$.10
		(1,000 bu)		
Dalhart	932	1,531	1,826	2,009
Stratford	724	1,180	1,477	1,706
Lautz	808	1,202	1,461	1,583
Spearman	1,100	2,242	2,382	2,595
Perryton	1,290	2,530	2,710	2,902
Hartley	2,392	2,410	2,428	2,428
Etter	1,006	1,339	1,359	1,366
Dumas	1,229	1,301	1,372	1,372
Panhandle	960	1,180	1,264	1,297
Pampa	964	1,680	1,767	1,826

but becomes marginally feasible at the average level of production with a $.10/bu rail rate reduction and 25-car load-out system. At the highest production level, Lautz is a suitable location for investment with either a $.075 or $.10/bu rail rate reduction and investment in a 25-car shipment system. This general trend is similar at other locations where upgrading investment was feasible. The exception is Spearman where the estimated rate of return on investment is greater at the low production level (21.6 million bushels) than the average production level (28.4 million bushels). This is due to the relatively dramatic increases in annual volume resulting from rail rate reductions when study region production is at the lowest level.

Elevators' Declining Gross Margins

A recent survey of Texas country elevators revealed an average gross margin (f.o.b. elevator grain sale price - farmer price) of $.215/bu, thus all previous analysis assumed this margin when calculating rate of return on upgrading investment. Changes in the competitive environment may unfavorably impact the upgraded elevator's margin and return. Competing elevators may reduce their

TABLE 12. ESTIMATED RATE OF RETURN ON 25-, 50-, AND 75-CAR UPGRADING INVESTMENT WITH PER BUSHEL RAIL RATE REDUCTIONS OF $.05, $.075, AND $.10 AND STUDY REGION WHEAT PRODUCTION OF 21.6 MILLION BUSHELS

	Estimated Rate of Return with Rail Rate Reductions of								
ELEVATOR LOCATIONS	$.05 (%)	$.075 (%)	$.10 (%)	$.05 (%)	$.075 (%)	$.10 (%)	$.05 (%)	$.075 (%)	$.10 (%)
	25-CAR INVESTMENT			50-CAR INVESTMENT			75-CAR INVESTMENT		
Dalhart	—	10.4	13.8	—	—	—	—	—	
Stratford	—	10.7	18.1	—	—	—	—	—	
Spearman	25.4	31.9	35.1	—	12.4	14.2	—	—	—
Perryton	102.6	122.5	141.6	20.3	26.5	32.5	11.6	16.3	20.8
Pampa	13.8	17.5	20.0	—	—	—	—	—	—

[1]Estimated rates of return are based on a gross margin of $.215/bu. Results are only shown for those locations where combinations of investment levels and rate reductions yield rates of returns approximating or exceeding 10%.

TABLE 13. ESTIMATED RATE OF RETURN ON 25-, 50-, AND 75-CAR UPGRADING INVESTMENT WITH PER BUSHEL RAIL RATE REDUCTIONS OF $.05, $.075, AND $.10 AND STUDY REGION WHEAT PRODUCTION OF 35.7 MILLION BUSHELS

	Estimated Rate of Return with Rail Rate Reductions of								
ELEVATOR LOCATIONS	$.05 (%)	$.075 (%)	$.10 (%)	$.05 (%)	$.075 (%)	$.10 (%)	$.05 (%)	$.075 (%)	$.10 (%)
	25-CAR INVESTMENT			50-CAR INVESTMENT			75-CAR INVESTMENT		
Dalhart	11.2	22.9	30.2	—	—	11.1	—	—	—
Stratford	9.8	24.3	35.5	—	—	13.4	—	—	—
Lautz	—	15.9	21.2	—	—				
Spearman	30.6	35.9	44.0	11.7	14.6	19.1	—	—	9.9
Perryton	128.1	148.0	169.1	28.3	34.5	41.1	17.6	22.3	27.3
Pampa	17.0	20.6	23.1	—	—	—	—	—	—

[1]Estimated rates of return are based on a gross margin of $.215/bu. Results are only shown for those locations where combinations of investment levels and rate reductions yield rate of returns approximating or exceeding 10%.

margin or obtain rail rate concessions, thus unfavorably affecting the upgrading elevator's ability to charge $.215/bu. Analysis in this section is based on the assumption that the upgraded elevator will meet competition by lowering its gross margin in order to retain its original volume. That is, competition is met by lowering its gross margin and retaining the original volume rather than retaining the $.215/bu margin and subsequently reducing annual wheat receipts.

Table 14 provides information on the effect of a declining gross margin on return of investments in multicar shipping capacity. The tabled information focuses on those locations where the estimated rate of return approximates or exceeds 10% when study region wheat production is the historical average of 28.4 million bushels. The results reveal the expected negative effect of a declining gross margin on upgrading elevator returns. In general, the rate of return on upgrading investment declines 2 to 3% for each $.01/bu reduction in gross margin. The exception is Perryton which experiences an abnormally large rate of return as a result of small upgrading investment. At Perryton, the rate of return on a 25-car load-out system declines by approximately 10 to 12% for each $.01/bu decline in gross margin. (See Tables 15 and 16 for the effect on returns of a declining gross margin at low and high annual wheat production levels.)

Effect of Not Operating the Study Region Short-Line Railroad

In November 1982, the Texas North Western Railway Co. (TNW) began operation of 83 miles of former Rock Island track between Etter, Texas and Hardesty, Oklahoma. Some recently created short-line railroads in the midwest have ceased operation because of financial problems, accordingly this analysis focuses on the feasibility of upgrading elevators to accommodate multicar shipments under the assumption that the TNW cease operations.

The analysis found the quantity of wheat received at Stratford, Lautz, Etter, Dumas, and Spearman to increase with nonoperation of the TNW railroad. Wheat receipts and return on upgrading investment increased modestly at Stratford with the $.075 and $.10/bu rate reductions when investing in a 25-car load-out system and with production of 28.4 million bushels. Abandonment of TNW operations modestly increased receipts at Spearman, Etter, and Dumas at existing rates and the three reduced rate levels; however, the effect on returns was negligible. As a result of railroad abandonment, the Lautz facility's return on upgrading investment with rail rate reductions of $.075 and the 25-car handling system became marginally profitable while the rate of return with a $.10/bu reduction improved the return rate sever-

TABLE 14. ESTIMATED RATE OF RETURN ON 25-, 50-, AND 75-CAR UPGRADING INVESTMENT WITH PER BUSHEL RAIL RATE REDUCTIONS OF $.05, $.075, AND $.10/BU, GROSS MARGINS VARYING FROM $.165 TO $.215 AND STUDY REGION WHEAT PRODUCTION OF 28.4 MILLION BUSHELS[1]

	Gross Margins					
Elevator Location	$.215 (%)	$.205 (%)	$.195 (%)	$.185 (%)	$.175 (%)	$.165 (%)
25-CAR INVESTMENT						
$.05 Rail Rate Reduction						
Spearman	19.0	16.6	14.2	11.8	9.4	7.0
Perryton	114.3	105.0	95.7	86.4	77.1	67.8
Pampa	15.3	13.2	11.0	8.9	6.7	4.5
$.075 Rail Rate Reduction						
Dalhart	16.5	14.4	12.3	10.2	8.0	5.9
Stratford	17.7	15.5	13.3	11.1	8.9	6.7
Spearman	24.1	21.3	18.5	15.7	12.9	10.1
Perryton	129.8	119.3	108.9	98.4	88.0	77.5
Pampa	19.0	16.6	14.1	11.7	9.3	6.8
$.10 Rail Rate Reduction						
Dalhart	20.9	18.5	16.0	13.6	11.1	8.7
Stratford	26.7	23.8	20.9	18.0	15.2	12.3
Lautz	9.5	7.6	6.0	4.5	2.9	1.3
Spearman	32.0	28.6	25.2	21.8	18.4	15.0
Perryton	151.1	139.0	126.9	114.9	102.8	90.7
Pampa	21.5	18.9	16.3	13.6	11.0	8.4
50-CAR INVESTMENT						
$.05 Rail Rate Reduction						
Perryton	23.9	21.0	18.1	15.2	12.3	9.4
$.075 Rail Rate Reduction						
Perryton	28.8	25.5	22.2	19.0	15.7	12.4
$.10 Rail Rate Reduction						
Spearman	12.5	10.6	8.7	6.8	5.0	3.1
Perryton	35.4	31.7	27.9	24.1	20.3	16.6
75-CAR INVESTMENT						
$.05 Rail Rate Reduction						
Perryton	14.4	12.2	10.0	7.8	5.6	3.4
$.075 Rail Rate Reduction						
Perryton	18.0	15.6	13.1	10.6	8.2	5.7
$.10 Rail Rate Reduction						
Perryton	23.0	20.2	17.4	14.5	11.7	8.8

[1]Results are only shown for those locations and combinations of investment levels and rate reductions where the rate of return approximates or exceeds 10% when the gross margin is $.215/bu.

al percentage points. In general, abandonment of TNW operations would not substantially improve the feasibility of investing in a multicar loading system at nearby elevators.

SUMMARY AND CONCLUSIONS

Recent legislation has legalized contracts between shippers and carriers. Generally, contracts between rail carriers and grain shippers involve volume commitments from the shipper in exchange for lower rail rates. Multicar grain shipments expedite railroad equipment handling, shorten equipment turnaround, allow for more productive use of railroad capital, and subsequently lower rail costs. Accordingly, railroads are often willing to contract at reduced rates to grain handlers making multicar, point-to-point shipments. Unfortunately, many country elevator facilities are not capable of making multicar grain shipments for which significant rate reductions are offered. Thus, substantial investment in elevator plants may be necessary before contracting can be an alternative.

This study focuses on the economic feasibility of upgrading 10 country elevators to load multicar wheat shipments (25-, 50-, and 75-car) in a 15-county area in the upper portion of the Texas Panhandle. Economic feasibility of upgrading the elevators is evaluated under alternative rail rate reductions ($.05, $.075, $.10), investments in 25-, 50-, and 75-car grain handling systems, three regional production levels and differing grain elevator margins. In addition, the analysis examines the impact of not operating a short-line railroad on the feasibility of upgrading investment in nearby elevators. Since export movements lend themselves to multicar, point-to-point hauls, the economic feasibility of upgrading is based only on wheat export volume.

Research objectives were accomplished in two phases of activity. The initial phase involves estimating wheat receipts and margin revenues at the upgraded country elevators as these facilities' export rail rates are adjusted downward to reflect their shipment in multicar units. This phase was accomplished with a network flow model which included export wheat flows which commenced at farm-level and terminated with port elevator loading of ocean-going vessels. In the second phase, elevator upgrading and operating costs are subtracted from the added revenues to calculate return attributable to each upgrading elevators' investment. Desirability of remodeling the country elevator to handle multicar shipments is provided by a return on upgrading investment.

Several scenarios were examined to identify the effect of various factors on the feasibility of upgrading investment at the 10 analyzed elevators. Initial analyses included study region wheat production approximating the historical average (28.4 million bushels), a gross elevator margin of $.215/bu and operation of the study region's short-line railroad. Rate of return on elevator upgrading investment was estimated for three rail reductions ($.05, $.075, and $.10) and three levels of upgrading investment (25-, 50-, and 75-car). Results show upgrading country elevators to accommodate 25-car grain shipments to be the most feasible. Six of the 10 study elevators had a rate of return on upgrading investment which approximated or exceeded

10 percent when operating with an export rail rate reduction of $.10/bu and investing in a 25-car grain shipment system. Investment in a 25-car grain shipment system was feasible for five elevators (earned a rate of return on upgrading investment exceeding 10%) when receiving a $.075/bu rail rate reduction and three elevators when operating with a $.05/bu rate reduction. Two elevators were feasible with upgrading investment in a 50-car system while only one elevator warranted investment in a 75-car grain handling system.

Further analysis showed rate of return on upgrading investment is effected by variation in annual wheat production, declining elevator margins, and nonoperation of the region's short-line railroad. As expected, the rate of return on upgrading investment is positively correlated with plant volume. When study region wheat production declines about 25% (21.6 million bushels) below average, the rate of return on 25-car upgrading investment declines 2 to 8 percentage points and investment in one plant which is feasible at the average production level becomes unwarranted (Table 15). When study region production increases to 35.7 million bushels, rate of return on plants increase (2 to 8%) and additional combinations of rail rate reductions ($.05, $.075, $.10) and investments (25-car, 50-car, 75-car) become feasible (Table 16). For example, five plants have attractive returns with a $.05/bu rail rate reduction and investment in a 25-car system, rather than the three plants which are feasible at the average production level.

Competing elevators may reduce their margin or obtain rail rate concessions which unfavorably affect the upgrading elevators ability to charge $.215/bu. The analysis revealed a negative effect of a declining margin on rate of return. In general, rate of return declined 2 to 3 percentage points for each $.01/bu reduction in margin. Additional analysis revealed that nonoperation of a short-line railroad would favorably effect nearby elevators but would not sufficiently increase returns at infeasible facilities to warrant investment.

Based on this study, careful and thorough analysis must be carried out prior to investing in multicar shipment capacity. Feasibility of investment is highly correlated with the cost of upgrading; that is, a plant which requires only modest investment has a much higher likelihood of obtaining an adequate return than a plant requiring extensive remodeling. Further, the quantity of grain flowing to the upgraded elevator is directly correlated with the size of the rail rate reduction. Rate of return on upgrading investment is closely associated with the amount of additional grain that flows to the upgraded elevator at lowered rail rates. For example, the six feasible elevator locations (25-car investment) had an average volume increase of 106% when rates were lowered $.10/bu, in contrast, the four infeasible locations had a 25% volume increase with a similar rate reduction. Density of grain production and competition from elevators in the upgrading elevators expanded market area impacts on the ability to attract larger volumes. Also, elevators that make the decision to upgrade must give special attention to the duration of their contracted rate advantage. Because of the long-term nature of the upgrading investment, the contract must include provisions that allow for lowered rates over an extended time period.

TABLE 15. ESTIMATED RATE OF RETURN ON 25-, 50-, AND 75-CAR UPGRADING INVESTMENT WITH PER BUSHEL RAIL RATE REDUCTIONS OF $.05, $.075, AND $.10/BU, GROSS MARGINS VARYING FROM $.165 TO $.215 AND STUDY REGION WHEAT PRODUCTION OF 21.6 MILLION BUSHELS[1]

	Gross Margins					
Elevator Location	$.215 (%)	$.205 (%)	$.195 (%)	$.185 (%)	$.175 (%)	$.165 (%)
25-CAR INVESTMENT						
$.05 Rail Rate Reduction						
Spearman	25.4	22.5	19.6	16.7	13.8	11.0
Perryton	102.6	94.2	85.8	77.4	69.0	60.6
Pampa	13.8	11.8	9.7	7.7	5.6	3.6
$.075 Rail Rate Reduction						
Dalhart	10.4	8.8	7.2	5.6	4.0	2.4
Stratford	10.7	9.1	7.4	5.7	4.1	2.4
Spearman	31.9	28.5	25.2	21.8	18.4	15.0
Perryton	122.5	112.6	102.7	92.8	82.9	73.0
Pampa	17.5	15.2	12.9	10.5	8.2	5.9
$.10 Rail Rate Reduction						
Dalhart	13.8	12.0	10.1	8.2	6.4	4.5
Stratford	18.1	16.0	13.8	11.6	9.4	7.2
Spearman	35.1	31.5	27.8	24.2	20.6	17.0
Perryton	141.6	130.2	118.9	107.5	96.2	84.8
Pampa	20.0	17.5	15.0	12.5	9.9	7.4
50-CAR INVESTMENT						
$.05 Rail Rate Reduction						
Perryton	20.3	17.6	15.0	12.4	9.7	7.1
$.075 Rail Rate Reduction						
Spearman	12.4	10.6	8.7	6.8	4.9	3.1
Perryton	26.5	23.4	20.3	17.2	14.1	11.0
$.10 Rail Rate Reduction						
Spearman	14.2	12.2	10.2	8.2	6.2	4.2
Perryton	32.5	28.9	25.4	21.8	18.3	14.7
75-CAR INVESTMENT						
$.05 Rail Rate Reduction						
Perryton	11.6	9.6	7.7	5.7	3.7	1.7
$.075 Rail Rate Reduction						
Perryton	16.3	14.0	11.7	9.3	7.0	4.7
$.10 Rail Rate Reduction						
Perryton	20.8	18.1	15.5	12.8	10.1	7.4

[1]Results are only shown for those locations and combinations of investment levels and rate reductions where the rate of return approximates or exceeds 10 percent when the gross margin is $.215 per bushel.

TABLE 16. ESTIMATED RATE OF RETURN OF 25-, 50-, AND 75-CAR UPGRADING INVESTMENT WITH PER BUSHEL RAIL RATE REDUCTIONS OF $.05, $.075, AND $.10/BU, GROSS MARGINS VARYING FROM $.165 TO $.215 AND STUDY REGION WHEAT PRODUCTION OF 35.7 MILLION BUSHELS[1]

	Gross Margins					
Elevator Location	$.215 (%)	$.205 (%)	$.195 (%)	$.185 (%)	$.175 (%)	$.165 (%)
	25-CAR INVESTMENT					
	$.05 Rail Rate Reduction					
Dalhart	11.2	9.4	7.6	5.8	4.0	2.3
Stratford	9.8	8.1	6.5	4.8	3.1	1.5
Spearman	30.6	27.3	24.0	20.8	17.5	14.2
Perryton	128.1	117.8	107.5	97.1	86.8	76.5
Pampa	17.0	14.7	12.4	10.1	7.8	5.5
	$.075 Rail Rate Reduction					
Dalhart	22.9	20.2	17.6	14.9	12.3	9.6
Stratford	24.3	21.6	18.8	16.1	13.3	10.6
Lautz	15.9	13.7	11.6	9.5	7.4	5.3
Spearman	35.9	32.2	28.6	24.9	21.2	17.5
Perryton	148.0	136.1	124.3	112.5	100.6	88.8
Pampa	20.6	18.1	15.5	12.9	10.4	7.8
	$.10 Rail Rate Reduction					
Dalhart	30.2	26.9	23.8	20.6	17.4	14.2
Stratford	35.5	31.9	28.4	24.7	21.2	17.6
Lautz	21.2	18.6	16.1	13.6	11.1	8.6
Spearman	44.0	39.7	35.4	31.1	26.8	22.5
Perryton	169.1	155.7	142.3	128.8	115.4	102.0
Pampa	23.1	20.4	17.6	14.9	12.1	9.4
	50-CAR INVESTMENT					
	$.05 Rail Rate Reduction					
Spearman	11.7	9.9	8.1	6.3	4.4	2.6
Perryton	28.3	25.0	21.8	18.6	15.3	12.1
	$.075 Rail Rate Reduction					
Spearman	14.6	12.6	10.6	8.5	6.5	4.5
Perryton	34.5	30.8	27.1	23.4	19.7	16.0
	$.10 Rail Rate Reduction					
Dalhart	11.1	9.4	7.6	5.9	4.1	2.4
Stratford	13.4	11.5	9.5	7.6	5.7	3.7
Spearman	19.1	16.7	14.4	12.0	9.6	7.2
Perryton	41.1	36.9	32.7	28.5	24.3	20.1
	75-CAR INVESTMENT					
	$.05 Rail Rate Reduction					
Perryton	17.6	15.2	12.8	10.3	7.9	5.5
	$.075 Rail Rate Reduction					
Perryton	22.3	19.5	16.7	14.0	11.2	8.4
	$.10 Rail Rate Reduction					
Spearman	9.9	8.3	6.6	4.9	3.2	1.6
Perryton	27.3	24.1	21.0	17.8	14.6	11.5

[1]Results are only shown for those locations and combinations of investment levels and rate reductions where the rate of return approximates or exceeds 10 percent when the gross margin is $.215 per bushel.

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